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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,919	12/20/2001	Masaru Seita	51343	9973
21874	7590	06/25/2004	EXAMINER	
EDWARDS & ANGELL, LLP P.O. BOX 55874 BOSTON, MA 02205				WONG, EDNA
ART UNIT		PAPER NUMBER		
		1753		

DATE MAILED: 06/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)
	10/027,919	SEITA ET AL.
	Examiner Edna Wong	Art Unit 1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 24 May 2004.
- 2a) This action is FINAL.      2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-3,5-7,10,11,14,15 and 17-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-3,5,10,11,15 and 19 is/are rejected.
- 7) Claim(s) 6,7,14,17,18 and 20 is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
  1. Certified copies of the priority documents have been received.
  2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
 Paper No(s)/Mail Date May 24, 2004.
- 4) Interview Summary (PTO-413)  
 Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: \_\_\_\_\_.

This is in response to the Amendment dated May 24, 2004. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

### ***Response to Arguments***

#### **Specification**

The disclosure has been objected to because of minor informalities.

The objection to the disclosure has been withdrawn in view of Applicants' amendment.

#### **Claim Objections**

Claim **10** has been objected to because of minor informalities.

The objection of claim 10 has been withdrawn in view of Applicants' amendment.

#### **Claim Rejections - 35 USC § 112**

Claims **1-3, 5-7, 10-11 and 13-20** have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The rejection of claims 1-3, 5-7, 10-11 and 13-20 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

Claim Rejections - 35 USC § 103

I. Claims **1-3, 5, 13 and 15** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564).

The rejection of claims 1-3, 5, 13 and 15 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. has been withdrawn in view of Applicants' amendment.

II. Claim **14** has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564) as applied to claims 1-3, 5, 13 and 15 above, and further in view of **Uzoh et al.** (US Patent No. 6,355,153).

The rejection of claim 14 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. as applied to claims 1-3, 5, 13 and 15 above, and further in view of Uzoh et al. has been withdrawn in view of Applicants' amendment.

III. Claims **6-8, 16, 18 and 20** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564).

The rejection of claims 6-8, 16 and 18 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. has been withdrawn in view

of Applicants' amendment.

**IV.** Claim 17 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Eckles** (US Patent No. 4,384,930) in combination with **Okinaka et al.** (US Patent No. 4,469,564) as applied to claims 6-7, 16 and 18 above, and further in view of **Uzoh et al.** (US Patent No. 6,355,153).

The rejection of claim 17 under 35 U.S.C. 103(a) as being unpatentable over Eckles in combination with Okinaka et al. as applied to claims 6-7, 16 and 18 above, and further in view of Uzoh et al. has been withdrawn in view of Applicants' amendment.

***Response to Amendment***

***Specification***

The disclosure is objected to because of the following informalities:  
page 4, the "BRIEF DESCRIPTION OF THE DRAWINGS" should be deleted since there are no Figs. 1 and 2.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

Claims 10-11 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap

between the steps. See MPEP § 2172.01. The omitted steps are: the method steps for filling vias in a substrate with copper.

Claim 10, lines 1-2, recites "A method for filling vias in a substrate with copper". However, the body of the claim recites only one step of "controlling an electrolytic copper plating solution ... by adding the thiol-reactive compound to the electrolytic copper plating solution ...". It does not appear that the "controlling" step is filling the vias in the substrate with copper.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

**I.** Claims 1-3, 5 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by **Mikkola et al.** (US Patent Application Publication No. 2002/0043468 A1).

The applied reference has a common assignee with the instant application.

Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in

the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Mikkola teaches an electrolytic copper plating solution suitable for filling vias in a substrate with copper, the solution comprising:

- (a) copper (page 3, ¶ [0027]);
- (b) water (*inherent*);
- (c) a water-soluble chlorine compound (page 3, ¶ [0032]);
- (d) a brightening agent compound having the structure represented by the formula of -X-S-Y- (= -R'-S-R-SO<sub>3</sub>X),  
wherein X (= R') is a carbon atom and Y (= R) is a carbon atom (page 4, ¶ [0041] to page 5, ¶ [0044]); and
- (e) a thiol-reactive compound chosen from carboxylic acids selected from formic acid and propionic acid (page 3, ¶ [0028]).

The compound having the structure represented by the formula of -X-S-Y- is selected from the group recited in claim 2 (page 4, ¶ [0041] to page 5, ¶ [0044]).

The electrolytic copper plating solution contains 0.1 to 100 mg/L of the compound having the structure represented by the formula of -X-S-Y- (= from about 0.1 to about 1000 ppm) [page 5, ¶ [0045]].

The thiol-reactive compound is present in the electrolytic copper plating solution in an amount from 1x10<sup>-4</sup> to 1.0x10<sup>-1</sup> mol/L (= from about 0 to about 100 g/L) [page 3, ¶ [0030]].

The copper comprises copper sulfate (page 3, ¶ [0027]).

II. Claims **1-3, 5 and 15** are rejected under 35 U.S.C. 102(e) as being anticipated by **Mikkola et al.** (US Patent No. 6,649,038 B2).

The applied reference has a common assignee with the instant application.

Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Mikkola teaches an electrolytic copper plating solution suitable for filling vias in a substrate with copper, the solution comprising:

- (a) copper (col. 5, line 60 to col. 6, line 7);
- (b) water (*inherent*);
- (c) a water-soluble chlorine compound (col. 6, line 63 to col. 7, line 3);
- (d) a brightening agent compound having the structure represented by the formula of -X-S-Y- (= -R'-S-R-SO<sub>3</sub>X),

wherein X (= R') is a carbon atom and Y (= -R) is a carbon atom (col. 7, line 5 to col. 8, line 5); and

- (e) a thiol-reactive compound chosen from carboxylic acids selected from formic acid and propionic acid (col. 6, lines 8-20).

The compound having the structure represented by the formula of -X-S-Y- is selected from the group recited in claim 2 (col. 7, line 5 to col. 8, line 5).

The electrolytic copper plating solution contains 0.1 to 100 mg/L of the compound having the structure represented by the formula of -X-S-Y- (= from about 0.1 to about 1000 ppm) [col. 8, lines 6-12].

The thiol-reactive compound is present in the electrolytic copper plating solution in an amount from  $1 \times 10^{-4}$  to  $1.0 \times 10^{-1}$  mol/L (= from about 0 to about 350 g/L) [col. 6, lines 38-43].

The copper comprises copper sulfate (col. 5, lines 60-64).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims **1-3, 5 and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lyde** (US Patent No. 3,674,660) in combination with **Okinaka et al.** (US Patent No. 4,469,564).

Lyde teaches an electrolytic copper plating solution suitable for filling vias in a substrate with copper, the solution comprising:

(a) copper (col. 2, lines 27-34);

(b) water (= aqueous) [col. 4, lines 2-6];  
(c) a brightening agent compound having the structure represented by the formula of -X-S-Y- (= -S-S-C-),  
wherein X is a sulfur atom and Y is a carbon atom (col. 2, lines 52-60); and  
(d) a thiol-reactive compound chosen from carboxylic acids selected from formic acid, propionic acid and oxalic acid (= auxiliary brighteners) [col. 3, lines 34-53].  
The copper comprises copper pyrophosphate (col. 2, lines 27-34).

Lyde does not teach a water-soluble chlorine compound.

However, Okinaka teaches that plating results are often improved by the addition of chloride ions (col. 4, lines 20-23).

Thus, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solution of Lyde with a water-soluble chlorine compound because Lyde teaches that the copper plating electrolytes of his invention may contain other additives that are conventionally employed in this type of electrolyte in addition to the heterocyclic brighteners (col. 3, lines 7-15). A water-soluble chlorine compound is HCl which is an additive that is conventionally employed in the electrolytic copper plating art to provide Cl<sup>-</sup> ions and to improve the plating results as taught by Okinaka (col. 4, lines 20-23).

As to wherein the compound having the structure represented by the formula of -X-S-Y- is selected from the group recited in claim 2, Lyde teaches that the copper plating electrolytes of his invention may contain other additives that are conventionally employed in this type of electrolyte in addition to the heterocyclic brighteners (col. 3, lines 7-15). A polysulfide compound is an additive that is conventionally employed in the electrolytic copper plating art to increase the ductility of the deposited copper as taught by Okinaka (col. 6, lines 3-25).

As to wherein the electrolytic copper plating solution contains 0.1 to 100 mg/L of the compound having the structure represented by the formula of -X-S-Y-, Okinaka teaches that the concentration of the polysulfide compound is typically between 0.0005 and 1.0 g/L (col. 6, lines 14-15).

As to wherein the thiol-reactive compound is present in the electrolytic copper plating solution in an amount from  $1 \times 10^{-4}$  to  $1.0 \times 10^{-1}$  mol/L, the concentration of the thiol-reactive compound is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would determine the success of the desired reaction to occur, absent evidence to the contrary. MPEP § 2141.03 and § 2144.05(b).

Furthermore, the skilled artisan has sufficient knowledge to select the appropriate concentration to induce the chemical reaction to occur. A concentration from  $1 \times 10^{-4}$  to  $1.0 \times 10^{-1}$  mol/L appears to be a mere optimization which solves no stated problems and

produces no unexpected results, unless proven otherwise.

Furthermore, Okinaka teaches that the auxiliary brightener is present at a concentration of 10 ppm.

### ***Allowable Subject Matter***

The following is a statement of reasons for the indication of allowable subject matter:

Claims **6-7, 17-18 and 20** define over the prior art of record because the prior art does not teach or suggest a process for filling vias in a substrate by electrolytic copper plating comprising the steps of contacting, applying and maintaining as presently claimed, esp., the step of maintaining a concentration of a compound having -X-S<sup>-</sup> structure equal or less than 2.0 micro mol/L.

Claim **14** defines over the prior art of record because the prior art does not teach or suggest the electrolytic copper plating solution according to claim 1, wherein the peroxy acids are chosen from performic acid, peracetic acid, peroxypropionic acid, peroxybutanoic acid or peroypentanoic acid.

Claims **10-11 and 19** define a method for filling vias in a substrate with copper comprising the step of controlling an electrolytic copper plating solution as presently claimed, esp., by adding the thiol-reactive compound to the electrolytic copper plating solution and maintaining a concentration of a compound having -X-S<sup>-</sup> structure equal or less than 1.0 micro mol/L.

The prior art does not contain any language that teaches or suggests the above. Therefore, a person skilled in the art would not have been motivated to adopt the above conditions, and a *prima facie* case of obviousness cannot be established.

Claims 6-7, 14, 17-18 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 10-11 and 19 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 5:00 pm, alt. Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Edna Wong  
Primary Examiner  
Art Unit 1753

EW  
June 23, 2004